THEORETIC HINTS

ON

An improved Practice

OF

BREWING.

(Price TWO SHILLINGS.)

THEORETIC HINTS

ON

An Improved Practice

OF

BREWING MALT-LIQUORS;

Including ſome Strictures

ON THE

Nature and Properties

OF

Water, *Malt*, and *Hops*;

The Doctrine of *Fermentation*;

The Agency of *Air*;

The Effects of *Heat* and *Cold*

On fermented Liquors, &c. &c.

By JOHN RICHARDSON.

Rerum cognoſcere cauſas. VIRG.

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Tho. Palmer

PREFACE.

THE deſign of the Author, in the publication of the ſubſequent pages, is rather to intimate the probability of a *complete ſyſtem of brewing*, than to promulgate one. Were he prompted by inclination to the undertaking, his intereſt would forbid the execution of it. The ordinary emoluments ariſing from the ſale of a book, however extenſive, would be a compenſation very inadequate to the fatigue of many years weariſome attention to the multifarious practice of a brewhouſe, employed in the production of almoſt every ſpecies of malt-liquor; or to the trouble of digeſting the œconomy of that practice, noting events, inveſtigating cauſes, and thence forming rules for the regulation and management of future proceſſes. To the ingenious, it is preſumed, theſe hints will not want utility, and to the mind unaccuſtomed to ſcientific diſquiſitions, a more perfect theory, without practical elucidation, might have been inefficacious. To both, in the preſent inſtance, the illuſtration of practice is neceſſary, where it is the intention of the enquirer perfectly to underſtand, in order to adopt, the principles upon which the Author's ſyſtem is founded, to which this publication is deſigned as preliminary information only.

Such an illuſtration muſt be perſonal, in conſequence of ſpecial agreement ; * from which it is preſumed that the brewery of London might vie with the country in the production of the finer *ales*, whilſt the country brewer, in return, might be convinced of the practicability of producing *porter* in his own office, of qualities equal, in every reſpect, to thoſe of the

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* See the Author's *Advertiſement addreſſed to the Common Brewers.*

ſame liquor brewed in the metropolis. Locality, in either caſe, is no further concerned in peculiar qualities (climate only excepted) than what ariſes from the difference in the nature of the water, which being ſo large a portion of the product, has indeed a very powerful influence. Yet, by a knowledge of the cauſes of that influence, we are enabled to make an artificial variation of proceſs ſupply natural defect, and to prove that common, which was before thought to be peculiar.

From experimental practice in ſeveral different parts of the kingdom,

dom, the Author is convinced of this truth; nor is he leſs aſſured, from obſervations on the continent, of the practicability of producing malt-liquors in all the northern parts of Europe (except where the cold is ſo intenſe as to prevent the action of fermentation) in as great perfection as in England. The climate of France, from Paris northward, of the French and Auſtrian Netherlands, of Holland, and of many parts of Germany, is well adapted to the brewing buſineſs, but the brewers know not how to reap the benefit of their ſituation. Thoſe of Paris are entirely ignorant of the art, as well as that of malting. Their malts have but juſt time to germinate ere they are dried off, whence they have ſcarce any of the fermentable principles of a perfect malt in them, and are of ſo ſteely a conſiſtence as to be hardly penetrable. Under theſe diſadvantages, it is not to be wondered at that their *bonne bierre de Mars* is ſuch a miſerable beverage. Did they purſue the method of malting inculcated in the following pages, and adopt a proper proceſs of brewing, the ſame quantity which they now make of wretched beer, for the retail price of ſix ſous the bottle, might be converted into a good porter, which ſells there for 25 ſous, or a pleaſing pale ale of equal value. And tho' this increaſe of price might not be entirely or immediately effected, on account of a prejudice common to all nations, of viewing in a ſecondary light every imitation, however near the original, yet it is uncontrovertible that ſuch a change in the quality, from a thin, ill-flavored, ſpiritleſs, to a pleaſant, ſprightly, vinous liquor, would be productive of emoluments exceeding, beyond all compariſon, the expence attending the acquiſition; and to conſider it in a public light, it will occur to every perſon, how much more wholeſome and invigorating muſt a ſound, nutritious malt-liquor be, than a meagre, hungry, ungenial wine, a liquor next in degree, above the crude, unformed beer here alluded to.

The Flemings, with every local advantage, are not many degrees beyond the French in the art of brewing, tho' malt-liquor is a beverage much more common in Flanders than in France. At Bruſſels, which ſome writers have celebrated for its beers, the beſt to be met with, in common, is of a browniſh amber, ſomewhat ſtrong and tranſparent, but for want of being brewed by a ſkillful artiſt, it fails in point of preſervation, and turns acid in warm weather. They have another ſort, pale and turbid, called *bierre blanche de Louvaine*, which is little better than thick ſmall beer. This being bottled whilſt new, is no ſooner uncorked than it flies furiouſly out of the bottle, like beer in the height of fermentation, and is drunk by the Flemings in that ſtate, with much ſeeming reliſh, tho' they acknowledge, at the ſame time, *it is not ſo good as Engliſh beer*.

The ſituation of Flanders is exceedingly favorable to the production of malt-liquors, particularly in and about Bruſſels. The ſoil is rich and fertile, well cultivated, and produces plenty of very good corn and hops, the latter of which are generally injured by hanging too long upon the plant, and by being gathered ſlovenly and bagged careleſly. The air is very much like that of many parts of England, and there is a plentiful ſupply of water, fit for every purpoſe of the brewer. But the beneficence of Nature will be unavailing, ſo long as her handmaid, Art, withholds her neceſſary aid. Were the Flemings to court the liberal diſpenſation of her favors, and obtain a knowledge of the principles of brewing, they might ſoon diſpute the palm with England, in the celebrity of malt-liquors; for even here, the number of places entitled to any degree of pre-eminent diſtinction is exceedingly limited, whilſt the majority of practitioners do but barely overtop thoſe of Flanders.

This extreme dearth of information, on a ſubject of ſuch general utility and importance, ought rather to be treated as a misfortune than a fault. Few, very few, of thoſe employed in the practice of a brewhouſe, have ever been taught to conſider brewing in any other than a mere mechanical light. Every maſter of a country ale-houſe, every hoſtler of a country inn, every ſervant of a country farmer, pretends to a proficiency in the art, and the man of ſcience is amazed to hear the common brewer dwell upon unaccountable difficulties, in a buſineſs practiſed with ſeeming eaſe, even by old women. Nor have thoſe who have taken upon them to write particularly on the ſubject, done any thing more than jumble together a number of recipes, in the ſtyle and manner of a *cookery-book*, or *family phyſician*, but with ſomewhat leſs efficacy. From theſe, one only may be excepted, who had the misfortune to be too abſtruſely philoſophical for common comprehenſion, and refined upon trifles till his theory frittered away the intention of his practice, and the product of both compleated their entire demolition.

The few ſtrictures here ſubmitted to the inſpection of the public, are not brought forward as the reſult of any deep reſearches into the chymic art, but as the leading principles of an improved ſyſtem of brewing, founded, indeed, on the eſtabliſhed laws of chymiſtry, but confirmed, in every reciprocal relation of cauſes and effects, thro' a ſeries of practice of many years continuance.

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Hence is the Author enabled to recommend, with confidence, his theory, as an illuſtration of his practice; and his practice, as a confirmation of his theory; at the ſame time that he propoſes an appeal to well-atteſted facts, as an additional ratification of both.

N. B. Thoſe gentlemen of the brewery in England or Scotland, who have not already received the Author's *Advertiſement of propoſals for teaching his methods of brewing porter and pale beers*, ſhall have copies forwarded to their reſpective addreſſes, on ſending a line, poſtage free, to *Joe's Coffee Houſe, Mitre Court, Fleet Street*, LONDON; thoſe in Ireland, to James Williams, Bookſeller, at DUBLIN, or Thomas White, Bookſeller, at CORK.

THEORETIC HINTS
ON
BREWING.

Of Water

THE general diſtinction of water, as it reſpects the common purpoſes of life, extends no further than the ſimple terms of *hard* and *ſoft*; and tho' it may not be in the power of every brewer to purſue his inclination in the choice of them, yet as there are ſome who can benefit of the diſtinction, by the poſſeſſion of both, and as all may profit by the judicious application of either, it may not be amiſs to ſay ſomewhat by way of diſcriminating their virtues, and pointing out their uſes in brewing.

Hard water, is that which being ſtrongly impregnated with certain terreſtrial matters, does not eaſily lather with ſoap, but cauſes it to curdle or coagulate, and is in general leſs fit for culinary purpoſes. Its ſpecific gravity is greater than that of ſoft water, whence its virtue as a menſtruum is conſiderably leſſened, as is evident by the inferior quality of worts extracted with hard, to thoſe with ſoft water, *ceteris paribus*; but the experienced brewer, in ſome meaſure, guards againſt this inconvenience, by expoſing his water, as much as he can, to the ſoftening virtue of the air, and by varying the extracting heat, which in hard water produces effects at a certain degree, ſimilar to thoſe producible only at a diſtant degree in ſoft.

In fermentation we find an equal diſadvantage in the uſe of hard water, which does not ſo readily incline to that action, whence there is a conſiderable deficiency in point of ſpirituoſity. As a preſervative it may be preferred, on account of its containing ſome alkaline qualities, which contribute to counteract any tendency to acidity, in the beer, and thence aſſiſt in its preſervation. Tranſparency is, alſo, more eaſily obtainable by the uſe of hard water; firſt, from its inaptitude to extract ſuch an abundance of that light, mucilaginous matter, which, floating in the beer, for a long time occaſions its turbidity; ſecondly, from its greater tendency to a ſtate of quietude, after the vinous fermentation is finiſhed, by which thoſe floating particles are more at liberty to ſubſide; and laſtly, from the mutual aggregation of the earthy particles of the water with thoſe of the materials, which, by their greater ſpecific gravity, thus aggregated, not only precipitate themſelves, but carry down alſo that lighter mucilage juſt mentioned. For theſe reaſons it is not well adapted to the brewing of porter, and ſuch beers as require a fulneſs of palate, when drawn to the great lengths of the London brewery, and of ſome country ſituations. But we can, by a judicious application of the extracting heat, and a peculiar mode of conducting the action of fermentation, produce from hard water, as far as Art can be the ſubſtitute of Nature, thoſe qualities which by unvaried practice are only obtainable from ſoft.

By *ſoft water* we mean that which being unburthened with the rigid earths, is of leſs ſpecific gravity, of more ſimple taſte, and of greater purity, which renders it more capable of entering the pores, and forming a ſolution of ſuch parts of the materials as yield to the impreſſion of the ſimple element.

The purity of water is determined by its lightneſs, and in this diſtilled water, only, can claim any material degree of perfection.

fection. Rain water is the pureſt of all, naturally produced; but by the perpetual exhalations of vegetables, and other fine ſubſtances floating in the atmoſphere, it does not come down to us entirely free of thoſe qualities which pond and river waters poſſeſs in a greater degree. Theſe, eſpecially of rivers running thro' fens and moraſſes, from the quantity of graſs and weeds growing therein, imbibe an abundance of vegetable ſolutions, which occaſions them to contain more fermentable matter, and conſequently to yield a greater portion of ſpirit, but at the ſame time induces ſuch a tendency to acidity as will not eaſily be conquered. This is more to be apprehended towards the latter end of the ſummer, than at any other ſeaſon of the year; becauſe theſe vegetable ſubſtances are then in a ſtate of decay, and thence more readily impart their pernicious qualities to the water which paſſes over them.

At ſuch an unfavorable time ſhould the brewer be neceſſitated to purſue his practice, it will behove him to pay the utmoſt attention to the cauſe of this diſpoſition in his liquor, and thence endeavor to prevent the ill conſequences, by conducting his proceſs to the extraction and combination of ſuch parts of the materials, as his judgment informs him will beſt counteract its effects.

Where there is the liberty of choice, we would recommend the uſe of that water which, from natural purity, equally free of the auſterity of imbibed earths, and the rankneſs of vegetable ſaturation, has a ſoft fulneſs upon the palate, is totally flavorleſs, inodorous, and colorleſs, whence it is the better prepared for the reception and retention of ſuch qualities as the proceſs of brewing is to communicate and preſerve.

Of Malt.

THE end of the proceſs of malting is well known, to every one concerned in the making and conſumption of malt, to be the production of that *ſaccharum*, upon which its value ſo eminently depends; but in the means of accompliſhing it, they are not ſo entirely agreed. In dry barley we find no appearance of this quality; the firſt efforts of vegetation diſcover none; let them continue a little longer, and we perceive its gradual production to a certain period; beyond that period it again begins to diſappear, and is ſoon totally loſt.

To inveſtigate the cauſes of theſe extraordinary changes, were a fruitleſs enquiry. Philoſophy may amuſe itſelf in tracing the imaginary gradation, till it be loſt with the principle it purſues. The man of buſineſs will here find a better account in noting effects than in attempting to diſcover cauſes, which in the productions of Nature will ever be hypothetical, till Art can make the copy like the original.

In the buſineſs of malting, ſimilar effects, in different ſubjects, are not produced at the ſame time, or in the ſame apparent ſtate of the grain, but vary according to their ſeveral natures and qualities. Thus Indian corn, and all the larger bodied grain is found to require a length of time ſufficient to ſhoot out a conſiderable acroſpire, before the production of its ſaccharine matter is perfect, whilſt that of barley would be entirely deſtroyed by the ſame practice.

The proceſs of making malt is an artificial, or forced vegetation, in which the nearer we approach the footſteps of Nature, in her ordinary progreſs, the more certainly ſhall we arrive at that perfection of which the ſubject is capable. The farmer prefers a dry ſeaſon to ſow his corn in, that the common moiſture of the earth may but gently inſinuate itſelf into the pores of the grain, and thence gradually diſpoſe it for the reception of the future ſhower, and the action of vegetation. The maltſter cannot proceed by ſuch ſlow degrees, but makes an immerſion in water a ſubſtitute for the moiſture of the earth, where a few hours infuſion is equal to many days employed in the ordinary courſe of vegetation, and the corn is accordingly removed as ſoon as it appears fully ſaturated, leſt a ſolution, and conſequently a deſtruction of ſome of its parts ſhould be the effect of a longer continuance in water, inſtead of that ſeparation, which is begun by this introduction of aqueous particles into the body of the grain.

Were it to be ſpread thin, after this removal, it would become dry, and no vegetation would enſue; but being thrown into the couch, a kind of vegetative fermentation commences, which generates heat, and produces the firſt appearance of germination. This ſtate of the barley is nearly the ſame with that of many days continuance in the earth, after ſowing, but being in ſo large a body, it requires occaſionally to be turned over, and ſpread thinner; the former to give the outward parts of the heap their ſhare of the acquired warmth and moiſture, both of which are leſſened by expoſure to the air; the latter to prevent the progreſs of the vegetative to the putrefactive fermentation, which would be the conſequence of ſuffering it to proceed beyond a certain degree.

To ſupply the moiſture thus continually decreaſing by evaporation and conſumption, an occaſional, but ſparing ſprinkling of water ſhould be given to the floor, to recruit the languiſhing powers of vegetation, and imitate the ſhower upon the corn field. But this ſhould not be too often repeated.

repeated; for as in the field too much rain and too little ſun, produce rank ſtems and thin ears, ſo here would too much water, and of courſe too little dry warmth, accelerate the growth of the malt, ſo as to occaſion the extraction and loſs of ſuch of its valuable parts, as by a ſlower proceſs would have been duly ſeparated and left behind.

By the ſlow mode of conducting vegetation here recommended, an actual and minute ſeparation of the parts takes place. The germination of the radicles and acroſpire carries off the coheſive properties of the barley, thereby contributing to the preparation of the ſaccharine matter, which it has no tendency to extract, or otherwiſe injure, but to encreaſe and meliorate, ſo long as the acroſpire is confined within the huſk; and by how much it is wanting of the end of the grain, by ſo much does the malt fall ſhort of perfection, and in proportion as it has advanced beyond, is that purpoſe defeated.

This is very evident to the moſt common obſervation, on examining a kernel of malt, in the different ſtages of its progreſs. When the acroſpire has ſhot but half the length of the grain, the lower part, only, is converted into that mellow ſaccharine flour we are ſolicitous of, whilſt the other half exhibits no other ſigns of it, than the whole kernel did at its firſt germination. Let it advance to two-thirds of the length, and the lower end will not only have encreaſed its ſaccharine flavor, but will have proportionally extended its bulk, ſo as to have left only a third part unmalted. This, or even leſs than this, is contended for, by many malt-ſters, as a ſufficient advance of the acroſpire, which they ſay has done its buſineſs as ſoon as it has paſſed the middle of the kernel. But we need ſeek no further for their conviction of error, than the examination here alluded to.

Let the kernel be ſlit down the middle and taſted at either end, whilſt green, or let the effects of maſtication be tried, when it is dried off; when the former will be found to exhibit the appearances juſt mentioned, the latter to diſcover the unwrought parts of the grain, in a body of ſtony hardneſs, which has no other effect in the maſh-tun than that of imbibing a large portion of the liquor, and contributing to the retention of thoſe ſaccharine parts of the malt which are in contact with it; whence it is a rational inference, that three buſhels of malt, imperfect in this proportion, are but equal to two of that which is carried to its utmoſt perfection. By this is meant the fartheſt advance of the acroſpire, when it is juſt burſting from its confinement, before it has effected its enlargement. The kernel is then uniform in its internal appearance, and of a rich ſweetneſs in flavor, equal to any thing we can conceive obtainable from imperfect vegetation. If the acroſpire be ſuffered to proceed, the mealy ſubſtance melts into a liquid ſweet, which ſoon paſſes into the blade, and leaves the huſk entirely exhauſted.

The ſweet thus produced by the infant efforts of vegetation, and loſt by its more powerful action, revives and makes a ſecond appearance in the ſtem, but is then too much diſperſed and altered in its form, to anſwer any of the known purpoſes of art.

The periods of its perfect appearance are, in both caſes, remarkably critical. It is at firſt perfect at the inſtant the kernel is going to ſend forth the acroſpire and form itſelf into the future blade; it is again diſcovered perfect when the ear is laboring at its extrication, and haſtening the production of the yet-unformed kernels. In this does it appear the medium principle of Nature's chymiſtry, equally employed by her in her mutation of the kernel into the blade, and her formation thence of other kernels, by which ſhe effects the completion of that circle to which the operations of the vegetable world are limited.

Were we to enquire, by what means the ſame barley, with the ſame treatment, produces unequal portions of the ſaccharine matter in different ſituations, we ſhould perhaps find it principally owing to the different qualities of the water uſed in malting. Hard water is very unfit for every purpoſe of vegetation, and ſoft will vary its effects according to the predominating quality of its impregnations. Pure elementary water is in itſelf ſuppoſed to be only the vehicle of the nutriment of plants, entering at the capillary tubes of the roots, riſing into the body, and there depoſiting its acquired virtues, perſpiring by innumerable fine pores at the ſurface, and thence evaporating, by the pureſt diſtillation, into the open atmoſphere, where it begins anew its round of collecting freſh properties, in order to its preparation for freſh ſervice.

This theory leads us to the conſideration of an attempt to encreaſe the natural quantity of the ſaccharum of malt by adventitious means; but it muſt be obſerved, on this occaſion, that no addition to water will riſe into the veſſels of plants, but ſuch as will paſs the filter; the pores of which appearing ſomewhat ſimilar to the fine ſtrainers or abſorbing veſſels employed by Nature in her nicer operations, we by analogy conclude, that properties ſo intimately blended with water as to paſs the one, will enter and unite with the economy of the other, and *vice verſa*.

Suppoſing the malt to have attained its utmoſt perfection, according to the criterion here inculcated, to prevent its farther progreſs, and ſecure it in that ſtate, we are to call in the aſſiſtance of a heat ſufficient to deſtroy the action of vegetation, by evaporating every particle of water, and thence leaving it in a ſtate of preſervation fit for the preſent or future purpoſe of the brewer.

Thus having all its moiſture extracted, and being, by the previous proceſs, deprived of its coheſive property, the body of the grain is left a mere lump of flour, ſo eaſily diviſible, that the huſk being taken off, a mark may be made with the kernel, as with a piece of ſoft chalk. The extractible qualities of this flour are, a ſaccharum, cloſely united with a large quantity of the farinaceous mucilage peculiar to bread corn, and a ſmall portion of oil, enveloped by a fine earthy ſubſtance, the whole readily yielding to the impreſſion of water applied at different times and different degrees of heat, and each part predominating in proportion to the time and manner of its application.

In the *curing* of malt, as nothing more is requiſite than a total extrication of every aqueous particle, if we had, in the ſeaſon proper for malting, a ſolar heat ſufficient to produce perfect dryneſs, it were practicable to produce beers nearly colorleſs; but that being wanting, and the force of cuſtom having made it neceſſary to give our beers various tinctures and qualities reſulting from fire, for the accommodation of various taſtes, we are neceſſitated to apply ſuch heats in the drying as ſhall not only anſwer the purpoſe of preſervation, but give the complexion and property required.

To effect this, with certainty and preciſion, the introduction of the thermometer is neceſſary; but the real advantages of its application are only to be known from experiment, on account of the different conſtruction of different kilns, the irregularity of the heat in different parts of the ſame kiln, the depth of the malt, the diſtance of the bulb of the thermometer from the floor, &c. &c. for tho' ſimilar heats will produce ſimilar effects in the ſame ſituation, yet is the diſperſion of heat in every kiln ſo irregular, that the medium ſpot muſt be found for the local ſituation of the thermometer, ere a ſtandard can be fixed for aſcertaining effects upon the whole. That done, the ſeveral degrees, neceſſary for the purpoſes of porter, amber, pale beers, &c. are eaſily diſcovered to the utmoſt exactneſs, and become the certain rule of future practice.

Tho' cuſtom has laid this arbitrary injunction of variety in our malt-liquors, it may not be amiſs to intimate the loſſes we often ſuſtain, and the inconveniencies we combat, in our obedience to her mandate.

The further we purſue the deeper tints of color, by an increaſe of heat beyond that which ſimple preſervation requires, the more we injure the valuable qualities of the malt. It is well known that ſcorched oils turn black, and that calcined ſugar aſſumes the ſame complexion. Similar effects are producible in malts, in proportion to the increaſe of heat, or the time of their continuing expoſed to it. The parts of the whole being ſo mutually united by nature, an injury cannot be done to the one without affecting the other; accordingly we find, that ſuch parts of the ſubject as might have been ſeverally extracted, for the purpoſes of a more intimate union by fermentation, are, by great heat in curing, burnt and blended ſo effectually together, that all diſcrimination is loſt, the unfermentable are extracted with the fermentable, the integrant with the conſtituent, to the very great loſs both of ſpirituoſity and tranſparency. In paler malts, the extracting liquor produces a ſeparation which cannot be effected in brown, where the parts are ſo incorporated, that unleſs the brewer be very well acquainted with their ſeveral qualities and attachments, he will bring over, with the burnt mixture of ſaccharine and mucilaginous principles, ſuch an abundance of the ſcorched oils as no fermentation can attenuate, no precipitants remove; for being in themſelves impediments to the action of fermentation, they leſſen its efficacy, and being of the ſame ſpecific gravity with the beer, they remain ſuſpended in and incorporated with the body of it, an offence to the eye, and a nauſea to the palate, to the lateſt period.

Of Hops.

THE chymical principles of vegetables, as far as Art has yet been able to diſcover, by analyſis, are *water*, *ſalt*, *oil*, and *earth*. Theſe, in different vegetables, do not only abound in different proportions, but vary in their ſpecies and properties. The water, being only the general medium of the whole, is the ſame ſimple element in all; the oil in ſome plants is more thin and fluid, in others more groſs and viſcous; the ſalt is in ſome more volatile, in others more fixed, in ſome acid, in others alkaline; the earth appears to be the mere uncharacteriſtic reſiduum of the whole, to which all have relation, and to which all finally return.

In hops, the quantity of oil is abundant; the finer part of an agreeable fragrance and great volatility; the coarſer, from its intimate union with an auſtere ſaline earth, of the alkaline kind, is groſſer in its odour, harſher in its flavor, and leſs ſubject to avolation.

The time of picking, the mode of curing, the care in bagging, the place of keeping, all have their ſhare in the preſervation or deſtruction of the finer qualities of this vegetable. If the hop be plucked too early, the conſequence of immaturity is obvious; if it hang too late, the conſtant avolation of its fine unctuous parts, waſtes its fragrance, deſtroys its color, and renders it of leſs value and efficacy. An application of too much heat in the curing has ſimilar effects; for by evaporating the aqueous parts of the vegetable too haſtily, the finer parts of the eſſential oil riſe with them and are loſt, whilſt the remainder receives an injury ſomewhat ſimilar to that of malt by the like injudicious treatment. The care in bagging and keeping is equally important, on the ſame principle of excluding, as much as poſſible, the action of the external air upon the hop, which carries off its more valuable qualities in the ſame manner, as by a too long continuance on the plant. The cloſer they are preſſed down in the bag, the more effectual is their ſecurity againſt this injury; and the beſt practical method of keeping them, is in a cloſe, but dry room, the bags laid upon each other, and the interſtices well filled with a dry inodorous matter, ſuch as the firſt ſcreenings of malt, &c.

Time, however, will impair their virtues, in ſpite of the utmoſt precaution, and that ſo rapidly, as to render them incompetent to the nicer purpoſes of the pale-ale brewer, after the expiration of the firſt year, in all the ordinary modes of preſerving them.

In theſe virtues of the hop are we to look for the primary principles of flavor and preſervation of malt-liquors, which are to be extracted in ſuch manner and proportion, as to the judgment of the brewer ſhall ſeem moſt likely to anſwer thoſe intentions. To accompliſh this, with certainty and advantage, particular attention muſt be had to the ſeveral ends of extracting, and the different effects of thoſe extracts upon the reſt of the proceſs; viz. whether the purpoſe of flavor will not defeat that of preſervation, and whether the too anxious purſuit of preſervation will not weaken the powers, and leſſen the effect of fermentation, to the very great loſs of the ſubject; for it is very certain, that every unctuous principle is an enemy to fermentation, and has a direct tendency to impair its action and deſtroy its efficacy.

Hence are we taught by reaſon, what is confirmed by experience, that the ſoluble parts of the hop, extracted ſeverally, anſwer ſeveral different purpoſes in beers, but taken collectively, tend to confound their virtues and pervert their uſes; and that in their extraction, if the means be not nicely proportioned to the end, the order of the proceſs is deſtroyed, and the intention of the brewer defeated.

Of Worts.

HAVING taken a curſory view of the materials themſelves, we come now to conſider more particularly the ſeveral modes of applying them, in order to extract their valuable parts, and the different effects of their application, in forming ſuch extracts.

We have already ſeen that barley, by a partial vegetation, ſtopped at a certain period, is converted into *malt*, a friable ſubſtance, eaſily reducible to a mellow flour, the ſoluble principles of which are, a ſaccharum, very diſtinguiſhable by the ſenſes, intimately united with a mealy, mucilaginous matter, and a ſmall portion of oil enveloped by an earth.

The quality of the ſaccharine part reſembles that of common ſugar, to which it is practicable to reduce it, and its charaςteriſtical properties are entirely owing to its intimate connection with the other parts of the malt, from which ſuch diſtinguiſhing flavors of beers are derived, as are not the immediate reſult of the hop. Were it not for theſe properties, the brewer might adopt the uſe of ſugar, molaſſes, honey, or the ſweet of any vegetable, to equal advantage, which cannot now be done, unleſs an eligible ſuccedaneum be found to anſwer that purpoſe. As we are at preſent circumſtanced, a ſearch on the other ſide would turn more to the brewer's account. We have in malt a ſuperabundance of the groſſer principles, and would government permit the introduction of a foreign addition to the ſaccharine, which is too deficient, many valuable improvements might be made from it; as we could, by a judicious application of ſuch adventitious principle, produce a ſecond and third wort of quality very little inferior to the firſt.

But in theſe experiments, a very particular attention would be neceſſary to the ſolvent powers of the water at different degrees of heat, and to the enquiry, How far a menſtruum already ſaturated with one principle, may be capable of diſſolving another? Such a conſideration is the more neceſſary on this occaſion, to direct us clear of two extremes equally diſagreeable: the firſt is, that of applying the menſtruum pure, and at ſuch a heat as to bring off an over proportion of the oleaginous and earthy principles, which would occaſion in the beer, thus wanting its ſhare of natural ſaccharum, a harſhneſs and auſterity,

ſterity, which ſcarce any time the brewer could allow would be able to diſſipate; the other is, that of previouſly loading the menſtruum with the adopted ſweet, in ſuch an abundance, as to deſtroy its ſolvent force upon the characteriſtical qualities we wiſh to unite with it, and thereby leave it a meer ſolution of ſugar. The requiſite mean is that of conſidering, what portion of the ſaccharine quality has been extracted in the firſt wort, according to the quantity of water and degree of heat applied, and then to make ſuch a previous addition of artificial ſweet as will juſt ſerve to counterbalance the deficiency, and aſſimilate with that portion of the remaining principles, we are taught to expect will be extracted with the ſucceeding wort.

From the nature of the conſtituent principles of malt, it is eaſy to conceive that the former, or ſaccharine and mucilaginous parts, yield moſt readily to the impreſſion of water, and that at ſo low a degree of heat, as would have no viſible effect upon the latter. If, therefore, we are to have a certain proportion of every part, it is a rational inference that the means of obtaining it, reſts in a judicious variation of the extracting heat, according to the ſeveral proportions required.

A low degree of heat, acting principally upon the ſaccharum, produces a wort replete with a rich, ſoft ſweet, fully impregnated with its attendant mucilage, and in quantity much exceeding that obtainable from increaſed heat; which, by its more powerful inſinuation into the body of the malt, acting upon all the parts together, extracts a conſiderable portion of the oleaginous and earthy principles, but falls ſhort in ſoftneſs, fullneſs, ſweetneſs, and quantity. This is occaſioned by the coagulating property of the mucilage, which, partaking of the nature of flour, has a tendency to run into paſte, in proportion to the increaſe of heat applied, by which means it not only locks up a conſiderable part of the ſaccharum contained therein, but retains with it a proportionate quantity of the extracting liquor, which would otherwiſe have drawn out the impriſoned ſweet, thence leſſening both the quantity and quality of the worts. And this has ſometimes been known to have had ſo powerful an effect, as to have occaſioned the *ſetting of the goods*, or the uniting the whole into a paſty maſs; for tho' heat encreaſes the ſolvent powers of water, in moſt inſtances, there are ſome in which it totally deſtroys them. Such is the preſent of flour, which it converts into paſte, beſides thoſe of blood, eggs, and ſome other animal ſubſtances, which it invariably tends to harden.

From a knowledge of theſe effects, we form our firſt ideas of the variations neceſſary in the heat of the extracting liquor, which are of more extenſive utility than has been yet intimated, tho' exceedingly limited in their extent, from one extreme to the other.

The moſt common effects of too low a heat, beſides ſometimes producing immediate acidity, are an inſipidity in the flavor of the beer, from a deficiency of thoſe characteriſtical

racteriſtical qualities before mentioned; and a want of early tranſparency, from the ſuperabundance of mucilaginous matter, extracted by ſuch heats, which, after the utmoſt efforts of fermentation, will leave the beer turbid with ſuch a cloud of its lighter feculencies, as will require the ſeparation and precipitation of many months to diſperſe.

The contrary application, of too much heat, at the ſame time that it leſſens the mucilage, has, as we have before ſeen, the effect of diminiſhing the ſaccharum alſo, whence that lean, thin quality obſervable in ſome beers; and by extracting an over-proportion of the oleaginous and earthy principles, renders the buſineſs of fermentation difficult and precarious, and impreſſes an auſterity on the flavor of the liquor, which will not eaſily be effaced.

Yet the true medium heat for each extract, cannot be univerſally aſcertained. An attention not only to the quality of the malt, but to the quantity wetted, is abſolutely neceſſary, to the obtaining every due advantage; nor muſt the period at which the beer is intended for uſe, be omitted in the account. The quality of the water, alſo, claims a ſhare in the conſideration, in order to ſupply that deficient thinneſs and want of ſolvent force in hard, and to allow for the natural fullneſs and fermentative quality of ſoft; a particular to which London, in a great meaſure, owes the peculiar mucilaginous and nutritious quality of its malt-liquors; tho' it is not an improbable conjecture, that the water of the *Seine*, and of ſome other large rivers, on the continent, would produce ſimilar qualities by ſimilar application.

Although the variations above alluded to are indiſpenſible, it is eaſy to conceive, from the ſmall extent of the utmoſt variety, that they cannot be far diſtant; if, therefore, we know that a certain degree extracts the firſt principles in a certain proportion, we need not much conſideration to fix upon another degree that ſhall produce the required proportion of the remaining qualities, and effect that equal diſtribution of parts in the extract, which it is the buſineſs of fermentation to form into a conſiſtent whole.

Of Boiling

THE principal uſe of this operation, as it reſpects the worts particularly, is to ſeparate the groſſer or more palpable parts of the extract, preparatory to that more minute ſeparation which is to be effected in the gyle tun. The eye is a very competent judge of this effect; for the coagulations or concretions into which the continued action of boiling forms thoſe parts, are obvious to the ſlighteſt inſpection, whilſt the perfect tranſparency of the interſtices of the worts, points out its utility in promoting that deſirable quality in the beer.

In purſuing this obſervation, we have the ſatisfaction to find the preceding theory of malt confirmed. The coagulating property of theſe parts, their ſuperabundance in the firſt wort, eſpecially from a low heat of liquor, the facility with which they form, and the ſuperior bulk of the concretions in that wort, ſpeak them to be parts of that farinaceous mucilage already explained; at the ſame time that the contrary appearances in the ſubſequent worts, their tardineſs to concrete, and the very minute particles into which they form, in proportion to the abundance of the oleaginous quality extracted with them, evince the nature and exiſtence of thoſe other principles before deſcribed; for we find, by a common culinary practice, that an unctuous and an aqueous body may be ſo intimately united, by the interpoſition of flour, and the action of fire, as to become of a uniform conſiſtence; which being then diffuſed in a larger body of boiling water, the coagulation of the flour, or the ſeparation of the whole, would with greater difficulty be produced than if ſuch union had not been.

With reſpect to the utility of decoction in extracting the virtues of the hop, it may be neceſſary to recur to the conſideration of that vegetable, in order to form ſome idea of the time requiſite to the ſeveral intentions of extraction.

The fine eſſential oil of hops being moſt volatile and ſooneſt extracted, we are thence taught the advantage of boiling the firſt wort no longer time than is ſufficient to form the extract, without expoſing it to the action of the fire ſo long as to diſſipate the finer parts of this moſt valuable principle, and defeat the purpoſe of obtaining it. To the ſubſequent worts we can afford a larger allowance, and purſue the means of preſervation ſo long as we can keep in view thoſe of flavor, to which no rules can poſitively direct, the proceſs varying with every variety of beer, and differing as eſſentially in the production of porter and that of pale ale, as the modes of producing wine and vinegar.

The conſequence of not allowing a ſufficient time for the due ſeparation of the parts of the wort, and extraction of the requiſite qualities of the hop, is obvious from what has been already ſaid; ſhould we proceed to the other extreme, we have every thing to apprehend, from the introduction of too large a portion of the groſſer principles of the hop, which are very inimical to fermentation, and from impairing the fermentative quality of the worts themſelves, by ſuffering their too long expoſure to the action of the fire paſſing thro' them, whereby they are reduced to a more denſe conſiſtence, and their parts too intimately blended to yield to the ſeparating force of fermentation, with that eaſe the perfection of the product requires.

Of Fermentation.

THE general definition of fermentation is, *a ſpontaneous internal motion of conſtituent parts, which occaſions a* *ſpontaneous ſeparation and removal from their former order of combination, and a remarkable alteration in the ſubject, by a new arrangement and re-union.* This deſcription is univerſal, and correſponds with the known effects of every ſpecies of the operation; but the particular kind to which our ſubject is limited, is the vegetable, which is again divided into the *vinous*, the *acetous*, and the *putrefactive*, forming a regular ſeries or gradation, from the firſt origin of its action, to the total annihilation of the ſubject; or, as Dr. Shaw expreſſes it, " The intention or " tendency of Nature, is to proceed from " the very beginning of vinous fermen- " tation, directly, in one continued ſeries " to putrefaction, and thence again to a " new generation; which appears to be " the grand circle, wherein all natural " things are moved, and all the phyſical " or rather chymical phænomena of the " globe produced."

It is not, however, the buſineſs of the artiſt to preſerve this circle, but to break

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the chain of connection in ſuch parts as may beſt anſwer the ends of his purſuit. Thus, the brewer is to ſtop the progreſs of the operation at the *vinous*, whilſt the vinegar-maker purſues it to the *acetous*, beyond which every purpoſe of art is defeated.

The reſult of vinous fermentation is the production of that inflammable ſpirit which is no where to be found previous to this action, and in which alone the ſtrength, or inebriating quality of beers conſiſts. Hence it is evident, that in proportion as we conduct fermentation to that degree of perfection of which it is capable, we ſhall produce that deſirable quality, and *vice verſa*.

The only mode we are yet acquainted with, of proving the preſence of this ſpirit, and determining the real ſtrength of beers, is by diſtillation, which is not only the criterion of vinous fermentation, but the proof of its perfection or imperfection, by the quantity of ſpirit produced. By the ſame means is the acetous fermentation diſtinguiſhed, which ſo alters, conceals, or deſtroys the inflammable ſpirit, that the ſtill only throws over an acid, uninflammable, aqueous liquor; which ſeems to point out that regular progreſs to the annihilation of the whole, which putrefaction is to effect.

The principles produced by both theſe ſpecies of fermentation ſeem to be alike purely *ethereal*; for they are ſo exceedingly volatile as to be in perpetual avolation, by the common heat of the air only; but their effects upon the human body are as widely different as thoſe of the operations which produce them. That which reſults from vinous fermentation, being by the heat of the ſtomach thrown up into the head, produces intoxication; whilſt that from the acetous, by a ſimilar evaporation, inſenſibly pervades the veſſels of the head, and exſudes thro' the pores of the ſkin, with extreme ſubtilty, in a viſible but cold perſpiration. Thus are we taught to draw the line of diſcrimination in a ſeries of cauſes, from a knowledge of effects only;

or, in other words, to determine the nature of the fermentation, from the quality of the principle produced.

The immediate ſucceſſion of the three ſpecies, ſeems to be the conſequence of continuing the ſubject in the ſame ſtate; for vinous fermentation is no ſooner completed, than the acetous commences, if the fermenting liquor be ſuffered to retain the ſame degree of heat; in which ſtate being incapable of depoſiting its proper feculencies, their ſuſpenſion and commotion in the body of the liquor, continue the action beyond the period of vinoſity, and the acetous fermentation of neceſſity enſues; which by a ſimilar continuation and expoſure to the external air, would immediately produce the putrefactive, and proceed to the completion of that circle, in which all the labored combinations of Art, reſolve into the firſt ſimple principles of Nature.

To mark the limits of diſtinction, and ſtop the progreſſive force of fermentation, at ſuch a period as ſhall beſt anſwer the brewer's purpoſe, in the production of every practicable degree of ſpirituoſity; and to conduct the action to that period, with every advantage to the ſubject, is a knowledge to be acquired not leſs from practical attention, than theoretical enquiries. It is our buſineſs here, only to aſſiſt the latter: the former requires an elucidation ſomewhat beyond the bounds of verbal inſtruction.

In the doctrine of fermentation, it is a maxim, that *ſuch ſubjects as are moſt ſeparable by means of water, air, and heat, have the greateſt tendency to ferment*; accordingly we find that wort, or the extract of malt, abounds in fermentable matter, but varies in quantity, in proportion to the heat and quantity of the liquor employed, agreeable to our theory of extracts. This fermentable matter we alſo find diſtinguiſhed into ſaccharine, mucilaginous, oleaginous, and earthy. An adequate proportion of each of theſe principles is neceſſary to a regular fermentation, and the production of a perfect, uniform beer..

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A ſurcharge of either, by deſtroying the equilibrium, changes the mode of the action, diſturbs the due arrangement of the parts, and produces effects agreeable to the nature of the predominating principle. Theſe effects, however, are not equally prejudicial to the beer; for we find that a ſurcharge of the ſaccharine and mucilaginous parts, tho' it occaſions that turbidity and rawneſs of flavor before-mentioned, is yet corrigible by time, and yields very readily to the action of precipitants; but an over-proportion of the oleaginous and earthy principles, beſides the evils before enumerated, eſpecially from the browner malts, is frequently productive of two of the moſt diſagreeable qualities that ever diſgraced the London brewery, where they have been particularly prevalent, and which time cannot correct, nor art effectually remove.

A due proportion of the fermentable principles being obtained, our next care is to collect the extracts into a body at ſuch a degree of heat as will facilitate the action, and to apply ſuch a portion of a proper ferment, as ſhall regulate and conduct it to the deſired period of perfection.

It is well known that the juices or extracts of all ſaccharine vegetables, have a natural and ſpontaneous tendency to ferment into a vinous liquor; this is alſo the property of wort, but the effects are not ſimilar. The expreſſed juices of fruits, the ſaccharine ſap of certain trees, &c. when collected into a body at a due degree of heat, of themſelves produce a wine, without the addition of a ferment; but worts, being loaded with an abundance of a tenacious mucilage, without yeaſt to aſſiſt and accelerate the efforts of nature, would run into an irregular and imperfect fermentation, or rather would immediately commence that *tumultuary motion* of their component parts, which is ſaid to produce putrefaction. This is, in a great meaſure, confirmed by the effect; for tho' we find that the action has been ſo far vinous, as to produce a ſmall portion of inflammable ſpirit, yet the putrefactive has at the ſame time been ſo prevalent, as to render the whole body of the liquor fetid and nauſeous in the extreme; a conſequence often derived from ſuffering worts to remain too long, or in too large a body, without yeaſt, eſpecially in warm weather, when they have a greater propenſity to ferment in a body of a few inches deep, than they have in cold, at the depth of as many feet.

A proper application of yeaſt prevents this accident, and diſpoſes the parts of the wort to that ſeparation and new arrangement, on which the perfection of the product depends.

The quantity of fermentable matter, already in action, thus conveyed into the body of the wort, aſſiſts its ſpontaneous aptitude to ferment, and a violent ſtruggle immediately enſues. The air contained in the yeaſt, being rarefied by the increaſed warmth it meets with in the wort, begins to break from its confinement, and eſcape at the ſurface, which is the firſt perceptible ſign of fermentation. In the rapid progreſs of its particles, towards the top, a ſmart attrition and colliſion are occaſioned, between thoſe particles, the body of the wort they paſs through, and the groſſer parts, which are, by their gravity, in contra-direction. By this attrition the oleaginous parts of the ſubject are ſeparated, (a property which air is peculiarly allowed to poſſeſs) and, being more ſubtile and diſpoſed to elaſticity, would be carried off with the air, were they not too intimately connected with and enveloped by the earthy, which are both too weighty to fly off, and too much inclined to collect and aggregate, by which means they at length, with the groſſer mucilage, ſubſide to the bottom, in the form of lees. But before this can be effected, by their adherence to the particles of air, to which they form a vehicle, they are rapidly carried to the ſurface, where the air burſting from them, the heavier fall down again towards the bottom, whilſt the lighter are ſupported, by the continual efflux of air, till the ſucceſſive burſting of bubble after bubble lets them down again into the liquor, and ſup plies their place with freſh matter. In their paſſage downwards, they are met by other innumerable particles of air, in the ſame rapid progreſs upwards, by which they are again carried to the ſurface, there to be left as before, till by repeated falling, colliſion, and attrition, ſome of the oleaginous particles are effectually ſeparated from the earthy, and united with the ſaccharine, to which they have a natural tendency, as is evinced by the ready incorporation of common ſugar and eſſential oils, by triture only, whence their miſcibility with aqueous ſubſtances is effected.

This union is no ſooner formed, than the continuance of the action proceeds to abſorb the finer parts of the earthy principle, which is left floating up and down in the liquor, after its ſeparation from the oleaginous; by which addition, and the intervention of the mucilage, that common medium, which fermentation rather tends to refine than diſunite, the whole is converted into a compact and uniform body.

The groſſer parts having, by this violent commotion, been completely ſeparated, and the finer recompoſed, the more weighty of the former fall to the bottom, whilſt the lighter, conſiſting principally of the refuſe mucilage, are carried to the top, where, by their glutinous adherence to each other, being ſupported by the collected air, they form a yeaſty head.

The action now languiſhes, the vinous fermentation is complete, and all that is wanting, is the prevention of the further progreſs of the operation, by dividing the ſubject into caſks, where it ſoon becomes of leſs heat, by which means the heavier particles condenſe and effectually ſubſide; the lighter, by the frequent filling up of the caſks, are collected nearly to a point, at the bung-hole, where being thrown off, they fall down the ſide, and leave the beer completely purged of all matter which might thereafter endanger a pernicious *ſtubbornneſs*, or deſtructive *fret*.

Were a confirmation of this doctrine neceſſary, we might perhaps find it in an attentive obſervance of the effects of fermentation, at different periods of its action. That the oleaginous and earthy principles are firſt ſtruck out of the body of the wort, is evinced by its remarkably ſweet flavor at that time, and the very groſs, bitter auſterity of the frothy head, which then contains the greater part of the unattenuated oils and earths; and that thoſe principles do unite and incorporate with the ſaccharine and mucilaginous, in the latter part of the operation, is proved by the gradual alteration in the flavor of the liquor, from a mixed ſweet to a uniform vinoſity, and a ſimilar change in the harſhneſs of the yeaſty head, which then aſſumes a like uniformity, ſo far as the term may be allowed to the aggregated refuſe of ſo many different principles.

The agency of air, in the buſineſs of fermentation, is very powerful, but as all fermentable ſubjects have an abundant ſupply, we are rather to provide for the egreſs of their own, than to ſuffer the admiſſion of the external air, by which a great number of the fine, volatile, oleaginous parts of the ſubject would be carried off, and a proportionate injury in flavor and ſpirituoſity ſuſtained. Hence ſuch a covering ſhould be provided for the gyle-tun as would barely allow the eſcape of the common air produced by the operation, whilſt the *gas*, or fixed air, from its greater denſity, reſting upon the ſurface of the beer the whole depth of the curb, prevents the action of the external air, and conſequently the eſcape of thoſe fine and valuable parts juſt mentioned.

This probable conſequence is the more to be depended on, from the known ſimilarity of effect which gas produces upon flame, which it immediately extinguiſhes, by preventing that rapid avolation of unctuous particles which is ſaid to conſtitute flame. In this inſtance the external air is the agent, which cauſes and conducts the avolation, and without a continual ſupply of which it cannot exiſt; this ſupply being effectually cut off by an immerſion of the ſubject in the gas of fermenting liquor, the flame is inſtantaneouſly extinguiſhed; nor will glowing fire itſelf exiſt in it a long time, tho' it contributes to rarefy and diſperſe it; and to animals inhaling it, a death as ſudden as by a ſtroke of lightning is the conſequence.

But towards the concluſion of vinous fermentation, this aerial covering begins to loſe its efficacy, which points out the neceſſity of then getting the beer into caſks, as ſoon as poſſible, that the conſequences may be prevented, of expoſing ſo large a ſurface, liable to ſo copious an evaporation. Amongſt theſe, a loſs of ſpirituoſity is not the leaſt; for this evaporation is more and more ſpirituous, as the action approaches the completion of vinous fermentation, and that once obtained, the loſs becomes ſtill more conſiderable, if ſtill expoſed to the air; whence it might be termed the diſtillation of Nature, in which ſhe is ſo much ſuperior to Art, that the ethereal ſpirit riſes pure and unmixed, whilſt the higheſt rectification of the ſtill produces, at beſt, but a compound of aqueous and ſpirituous parts.

Nor is this entirely conjecture. Experience teaches us, that we cannot produce ſo ſtrong a beer in ſummer, *ceteris paribus*, as in winter; the reaſon is, not becauſe the action of fermentation does not realize ſo much ſpirit in warm weather, but becauſe the fermenting liquor, after the perfection of vinoſity, continues ſo long in a ſtate of rarefaction, that the ſpirituous parts are diſſipated in a much greater degree at that time, than at any other, in a ſimilar ſtate of progreſſion. And this doctrine of natural diſtillation ſeems to account for that increaſe of ſtrength obtainable from long preſervation, in well cloſed caſks, and, more particularly ſo, in glaſs bottles; for Nature, in her efforts to bring about her grand purpoſe of reſolving every compound into its firſt principles, keeps up a perpetual internal ſtruggle, as well as an external evaporation, and if the latter be effectually prevented, the former muſt be productive of additional ſpirituoſity,

tuoſity, ſo long as the action keeps within the pale of vinous fermentation

In order to maintain a due regulation of the fermenting power, and to anſwer the ſeveral purpoſes of the operation, a ſcrupulous attention to the degree of heat at which the action commences, and a particular regard to the quality and quantity of the ferment employed, are indiſpenſibly neceſſary.

The quality of the yeaſt requires the more minute ſcrutiny, becauſe it is not poſſible to produce a perfect and effectual fermentation, without it be good, evinced by its lively, elaſtic appearance, and powerful effect in application. The quantity can only be aſcertained, by the intention of the artiſt. In many inſtances, a larger portion is tantamount to a higher degree of fermenting heat, and *vice verſa*; but this is chiefly confined to the purpoſe of accelerating the proceſs. If the operation be too languid, from a want of heat in the fermenting liquor, an addition of freſh yeaſt may ſupply the deficiency, and effect the required recompoſition of parts, without which there is not only an immediate loſs of ſtrength, but ſuch a derangement of the preſervative principles, as will effectually prevent their reunion, and leave the imperfect product to the certainty of early deſtruction. The action, in this inſtance, having only ſufficient force to ſeparate, and being unable to attenuate and recompoſe the oleaginous and earthy parts of the ſubject, the body of the beer remains a heavy, unconcocted farrago of the whole conſtituent principles, of a fulſome, ſweet, mawkiſh flavor, prompt to a ſtubborn fret, on the firſt change of air, and conſequent acidity, the final period of its exiſtence as a vinous liquor.

This, alſo, leads us to the neceſſity of completing the vinous fermentation, previous to *cleanſing*, or putting the liquor into caſks, which change of quantity and ſituation, alters the action from fermentation to *purgation* only; for thoſe parts which in the gyle-tun are carried to the top and repeatedly fall again into the body of the liquor, to be there further ſeparated, attenuated, refined, and recompoſed, are, in the caſk, thrown off entirely, and periſh in the *ſtillion*, or receiver, before they can be returned again, by filling up the veſſel.

The conſequences of ſuch a violent diſunion, have been before noted; to which may be added, the great loſs of ſpirituoſity, occaſioned by ſo premature a diviſion of the fermenting liquor into ſmaller quantities, which immediately checks the operation, and prevents its being brought to a proper criſis, both from the preternatural diſcharge of the caſk, and the want of a ſufficient body to accompliſh that end; for it is not in the power of art to produce a proportionate quantity of ſpirit from a ſmall body of wort, to that which is obtainable from a large one, tho' of equal quality in every reſpect.

The effects of a contrary conduct, in ſuffering the liquor to remain in the tun after the period of vinous fermentation, have been already ſufficiently intimated;

but

but the criterion which marks the exact period of maturity, reſting more upon the diſcrimination of the ſenſes, than an appeal to the underſtanding, we muſt leave to the illuſtration of practice, what lies beyond the documents of theory to define.

In theſe ſtrictures, the *uſe of the thermometer* has been all along implied, without which all theory is ineffectual, all practice uncertain. We have ſeen that the variation of a few degrees of heat in forming the extracts, produces an important difference of effect. In the heat of fermentation, ſimilar conſequences reſult from ſimilar variety. Under a certain regulation of the proceſs, we can retain in the beer, as far as art is capable, the finer mucilage, and thereby preſerve that fullneſs upon the palate which is by many ſo much admired; on the other hand, by a ſlight alteration, we can throw it off, and produce that evenneſs and uniformity of flavor, which has ſcarce any characteriſtical property, and is preferred by ſome, only for the want of that heavineſs which they complain of in full beers. If a more vinous, racy *ale* be required, we can, by collecting and confining the operation within the body of the wort, cauſe the ſeparation and abſorption of ſuch an abundant portion of the oleaginous and earthy principles, as to produce a liquor in a ſtate of perfection at the earlieſt period, and ſo highly flavorous, as to create a ſuſpicion of an adventitious quality.

Thus, by a judicious management of this moſt difficult and intereſting part of the brewing proceſs, we are enabled to influence natural flavor, ſpirituoſity, and preſervation. By a further improvement, we can introduce foreign virtues, (as in the inſtance of *porter*, &c.) anticipate age, and produce in two months the properties and characteriſticks of twelve.

Of Cellarage.

THE *diſorders of the cellar* are frequently mentioned among the grievances of the brewer, tho' they have in reality no exiſtence. Every diſorder in beers has its origin in the brewhouſe, except thoſe which ariſe from palpable neglect; ſuch as the flatneſs occaſioned by leaving the veſſels unſtopped, and the conſequences ariſing from the uſe of a cellar ſo ill defended from the external air, as to expoſe the beer to every viciſſitude of weather, from the extremity of ſummer's heat, down to the ſeverity of winter's cold.

The former points out its own prevention, but its remedy muſt be ſought in a freſh fermentation, artfully introduced, and moderately conducted. Upon the latter, as a particular often diſregarded, a few thoughts may not be uſeleſs.

The temperature of the air to which beers ought generally to be expoſed, for the purpoſes of perfect preſervation, and the advantages of age, is that which equally avoids the two extremes, and is kept as uniformly invariable as the excluſion of either will permit. By Farenheit's thermometer we find the ſummer heat to be at 76 degrees, and the point of freezing at 32. Experience teaches us to adopt the intermedium, as the moſt certain means of avoiding the effects of that rarefaction and natural diſtillation before treated of, and the contrary conſequences of advancing towards the oppoſite extreme of *concentration*, or freezing the aqueous parts of the liquor.

In proportion to the warmth of the air, as has been already intimated, the whole body is rarefied, the ſpirituous parts are thence more eaſily ſet at liberty, and their conſtant avolation encreaſed; by which a proportionate injury to the flavor, and a diminution of the ſtrength are effected; for tho' the caſks may be very well cloſed, the extreme ſubtilty of this ſpirituous evaporation will find means to pervade the head of the veſſel, which in a warm, dry ſituation, is not a little diſpoſed to favor the eſcape, whereas the humidity inſeparable from a cloſe, cool cellar, ſo ſaturates the wood as to render it, in a conſiderable degree, impervious to the flying vapor. Nor is this diſſipation of ſpirituous parts thro' the pores of the wood, to be deemed the chimera of conjecture. We have a confirmation in point, in the known effect of keeping diſtilled liquors in casks, which is an evident loſs of ſtrength, eaſily demonſtrable by the hydrometer or hydroſtatic balance; whilſt thoſe kept in glaſs, continue for years without any material alteration. But glaſs itſelf is inſufficient for the purpoſes of the preſent occaſion; becauſe the increaſed heat of air excites a freſh commotion in the beer, which immediately proceeds to acidity, and the conſequent mutation of the ſpirit, from an inflammable to an uninflammable principle.

On the contrary, a degree of cold, as it approaches to the freezing point, by condenſing, proportionally leſſens that diſpoſition to evaporate, but equally tends to concentrate the ſpirituous parts; which would actually happen, ſhould the degree of cold be ſo intenſe as to freeze the liquor. In that caſe, the cold acts only upon the aqueous parts, beginning with thoſe in contact with the veſſel, and thence advancing towards the centre, forcing the ſpirituous parts inwards, till the concentrated liquor is of ſufficient ſtrength to reſiſt an extreme degree of cold, as has frequently been inſtanced in the freezing of a caſk of ſmall beer, in the manner here treated of, to ſuch a degree, that the liquor in the centre became of a quality equal to ſtrong.

This is only quoted, in order to intimate the diſadvantages of concentration, and, of courſe, all approaches thereto; for the aqueous parts being, by that means, gradually detached, become in a certain degree pure water; and it is notorious that water mixed with ſtrong beer, as an occaſional beverage, makes a diſagreeable, flat, double-flavored liquor. The effect of concentration, if not equal, is ſimilar, as would be experienced on the firſt change of air of ſufficient warmth to ſet theſe aqueous or periſhed parts at liberty to reunite with the concentrated liquor; and tho' this accident could ſcarce ever happen to a perſon but moderately attentive to his buſineſs, there are ſome who approach too near the cauſe of it, to be entirely unaffected by the conſequence.

Of the two extremes, an inclination to the latter may be leaſt prejudicial, as only tending to a ſeparation, which it is in the power of a new fermentation to rectify, whilſt the effects of the former are, a diſſipation of the more valuable parts, and a diſpoſition of the remainder to inevitable deſtruction.

To purſue this ſubject beyond its preſent limits were to exceed the purpoſe of the author, who reſerves the further elucidation of his theory for the perſonal application of thoſe who wiſh to be more fully informed, by the convincing arguments of practical confirmation, and the corroborating teſtimony of facts.

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